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Book of abstracts

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MEASURING DISPLACEMENT FIELD AND DETECTION OF UNBONDED REGIONS IN A SINGLE LAP JOINT WITH MOIRÉ INTEREFEROMETRY

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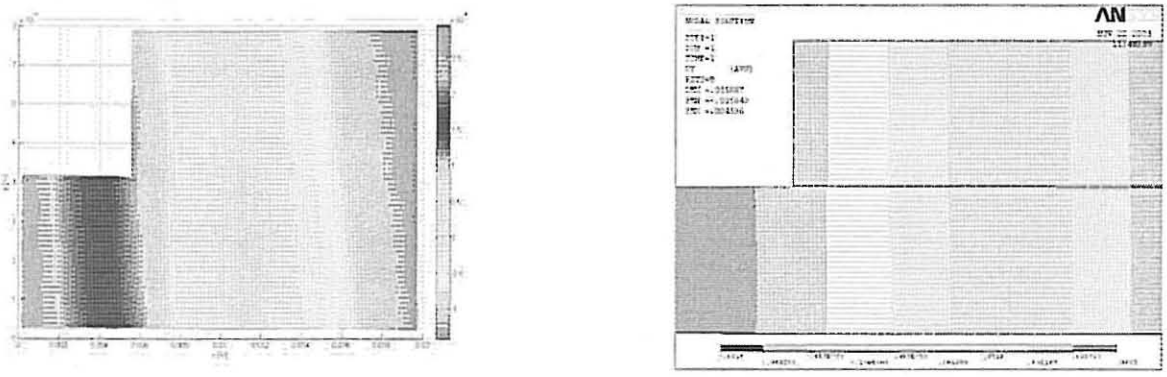
Conference Topic:

Abstract

The goal of this work is the development of an experimental technique to measure the displacement field and to perform detection of unbonded regions [1] in a single lap joint [2, 3]. The proposed experimental technique is based on the use of Moiré Interferometry. It is a field technique that allows in-plane displacement measurements without contact and with high resolution [4, 5]. Grating replication techniques were developed to record high quality diffraction gratings onto the specimen's surfaces [6]. An optical set-up of laser interferometry was developed to generate the master grating (virtual) [7]. A tension load was applied to a lap joint and its deformation was accessed by the interference between the reference grating, recorded on the object surface, and virtual master grating generated by laser interferometry. A phase shifting technique [8] was implemented to allow the phase map calculation and Image processing techniques [9] will be used to assess the in-plane displacement field.

Numerical simulations obtained with the finite element code ANSYS were used to calculate the displacement field [10, 11]. An unbonded region in a single lap joint was numerically simulated with isoparametric quadrangular element of eight nodes and results compared with those obtained in the experimental work. The displacement fields experimentally measured (a) and numerically calculated (b) for the horizontal direction are represented in figure 1, for a single lap sound joint.



(a) (b)

Figure 1 – Displacement field: (a) experimental results; (b) numerical simulation.

Figure 2 represents the simulation of a single lap joint with an unbonded region. As can be seen in this figure, the debonded region is clearly seen in the strain field. A defected lap joint will be produced and used to record its displacement field. Differentiation algorithms will be used to access the displacement field gradients.

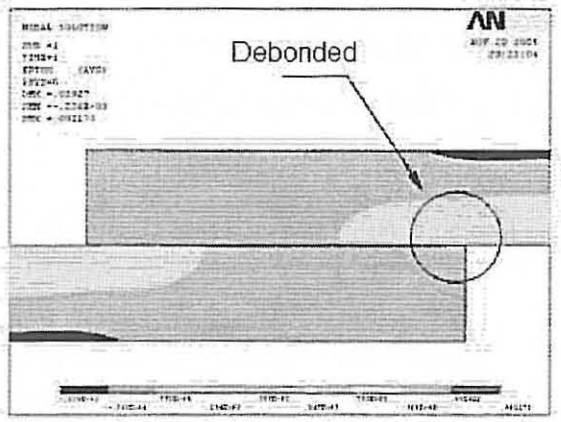


Figure 2 – Numerical simulation of a single lap joint with an unbonded region.

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FULL PROGRAMME

SUNDAY 9TH JULY 2006

18:00-20:00 Pre-registration and welcome reception at the *Holiday Inn* hotel, downtown Clermont-Ferrand

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MONDAY 10TH JULY 2006

08:00 Registration and refreshments

08:45 Welcome address
Blaise Pascal Amphitheatre

KEYNOTE LECTURE 1

Blaise Pascal Amphitheatre
Chair: J.M. Dulieu-Barton, University of Southampton, UK

09:00 ***Photomechanics in dynamic fracture and friction studies***
K. Ravi-Chandar (USA)

Session 1 **– FRACTURE MECHANICS**

Blaise Pascal Amphitheatre
Chair: J.M. Dulieu-Barton, University of Southampton, UK

09:45 ***Application of photoelasticity in mathematical modelling of crack tip stress fields***
K. F. Tee (United Kingdom), C. J. Christopher (United Kingdom), E. A. Patterson (USA) and M. N. James (United Kingdom)

10:05 ***Optical investigation of mixed-mode dynamic crack growth in a functionally graded composite***
H. V. Tippur and M. S. Kiruguilige (USA)

10:25 ***The path of a growing crack - experiment and simulation***
P. Ståhle, C. Bjerkén and J. Gunnars (Sweden)

10:45 Refreshments

16- Application of full field optical measurement techniques to investigate variability of Poisson effect in wood and wood-plastic composites (WPC) in creep conditions
H.-L. Frandsen (Denmark), L. Muszynski (USA), Y. Wang (USA) and A. Sevrain (France)

17- Identification of orthotropic stiffness of composites with the virtual fields method: optimization and experimental validation
F. Pierron, G. Vert (France), R. Burguete (United Kingdom), S. Avril, R. Rotinat (France) and M. Wisnom (United Kingdom)

18- Identification of elastoplastic parameters distributions using digital image correlation
F. Latourte, A. Chrysochoos, S. Pagano and B. Wattrisse (France)

19- A coupled FE based inverse strategy from displacement field measurement subject to an unknown distribution of forces
E. Pagnacco and D. Lemosse (France)

20- Analysis of the strain distribution during the simple shear test using the digital image correlation method
A Aouafi, M. Gaspérini and J.-L. Dournaux (France)

21- Measuring displacement field and detection of unbonded regions in a single lap joint with moiré interferometry
J. Ribeiro, M. Vaz, H. Lopes, J. Monteiro and P. Piloto (Portugal)

22- Experimental evidence of the load transfer zone in curved composite patches using the grid method
J.-D. Mathias, X. Balandraud and M. Grédiac (France)

23- Characterization of the mechanical behaviour of cancellous bone by means of a three dimension scanner technique
C. Noirfalise, G. Poumarat and J.-F. Destrebecq (France)

24- Generalized onion-peeling method for integrated photoelasticity of axisymmetric problems
J. Anton and H. Aben (Estonia)

25- Strain field analysis of cancellous bone under compression by image correlation
H. Lopes, C. Nabais, R.M. Guedes, J.-L. Morais and J.-A. Simoes (Portugal)

26- Discrepences between experiments and modelling : 3D-ESPI deformation measurements on compact tension test
B. Gautier, A.-S. Bretelle, P. Lenny and P. Slangen (France)

27- A novel application of electrolytic plating as a birefringent coating for photoelastic techniques
J. Nawasra, G.C. Calvert and P. Bryanston-Cross (UK)

Exhibitors

1- CEDIP Infrared

2- Foretech

3- Polytech-Pi